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Published in:
Review of Development Economics

DOI:
10.1111/rode.12291

Publication date:
2017

Document version
Publisher's PDF, also known as Version of record

Review of Development Economics, 21(2), 285–303, 2017
DOI:10.1111/rode.12291

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Abstract

Aid and aid institutions constitute an important element of the global response to interlinked global developmental and environmental challenges. As such, these institutions are now being drawn into new arenas beyond the traditional focus on improving the livelihoods of poor people in low-income countries. Development aid, by itself, cannot "save the planet." Nevertheless, development aid and development institutions do have the potential to become important catalytic actors in achieving developmental and global environmental objectives. This requires bold reforms and political action. Without appropriate restructuring of the international institutional architecture to confront the new development context combined with the necessary complementary policy frameworks, future aid, including aid for environmental objectives, risks substantially under-performing.

1. Introduction

We focus here on the implications of global environmental change in general and climate change in particular for the international institutional architecture as it relates to the conduct of foreign assistance. The paper is designed to serve as a capstone to this special issue with the aim of bringing together the existing pieces of evidence in a new and coherent manner and drawing out what can be said at this juncture. A common theme is that aid and aid institutions constitute an important element of the global response to interlinked global developmental and environmental challenges. The process of engaging aid institutions in addressing interlinked environmental and developmental challenges has recently been formalized in the form of the Sustainable Development Goals (SDGs) approved by the United Nations General Assembly in September 2015. While formal goals have been established,[1] the means for achieving them remain as work in progress. The same goes for the 230 indicators associated with the goals as well as assessment of the potential tradeoffs between goals. Here, we argue that substantial institutional reforms are required to confront environmental challenges alongside traditional development challenges amid a new geography of poverty and fragility.

The rest of this article is structured as follows. Section 2 describes the context in which development aid operates emphasizing both the continuation of traditional goals centered on poverty reduction (see SDG 1) and the emergence of new goals, frequently driven by environmental concerns (such as SDG 13). Section 3 considers how the aid system has responded to this new context with particular emphasis on initiatives designed to confront environmental challenges. Agriculture sits at the core of traditional development issues (and hence aid) and the sector also has strong environmental implications. It both impacts and is impacted by climate.

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The copyright line for this article was changed on 09 February 2017 after original online publication.

Agriculture is therefore treated as a cross-cutting issue in sections 2 and 3. Section 4 then considers the future role of aid with emphasis on environment and climate change. This section contains five lessons for the future role of foreign assistance. A final section reasserts the need for bold reform of the existing aid institutional structure and for equally bold policy initiatives in order to meet development challenges of the 21st century.

2. The Context

Since about 1960, aid has sought to improve the economic and social conditions of poor people; and a wide range of key indicators of well-being have improved markedly during that time span. Notable improvements have been registered in, for example, per capita gross domestic product (GDP), consumption poverty, infant mortality, life expectancy and educational attainment. The role of aid in bringing about these improvements has over the years been the subject of much debate. In a review of recent studies, Arndt et al. (2015b) find that the scales in this debate have tipped in favor of aid since 2008. The bulk of the available up-to-date evidence points to positive and significant results. They conclude that aid has contributed positively to economic growth and to a host of other economic and social indicators. The recent literature also highlights the long time frames (three decades or more) required for positive impacts to materialize and that there is a significant heterogeneity of experience, particularly over the shorter time frames sometimes in focus (e.g., Djankov et al., 2008).[2]

In spite of these positive results, ample development challenges remain. With respect to the traditional concerns of poverty, vulnerability, food security and marginalization, about 900 million people are absolutely poor in today's world (down from about two billion people in 1990). In addition, 36 countries continue to be mired in low-income status (down from 63 countries in 2000). The Organisation for Economic Co-operation and Development (OECD) characterizes an even larger number of states (47), as fragile, implying that some middle-income countries are characterized as fragile (OECD, 2012).

The contours of the development challenge are also changing. The remaining group of low-income and fragile states likely represent a core of more difficult cases where reliance on standard development recipes may not be sufficient. Importantly, owing to the graduation of many states to middle-income status, the geography of poverty has shifted. Not long ago, the vast bulk of absolutely poor people lived in low-income countries. Today, about three out of four absolutely poor persons live in middle-income countries.

Finally, huge environmental challenges overlay and interact with more traditional development challenges. Humanity now confronts a series of environmental challenges grouped under the rubric of global environmental change. Climate change is a leading element given its potential to transform the environment of the planet and its role as a driver behind other environmental issues such as biodiversity loss and ocean acidification (World Bank, 2012). Formal analysis of the distribution of likely climate outcomes by Webster et al. (2012), based on unconstrained or only mildly constrained emissions, imply a near certainty of temperature rises associated with 'dangerous anthropogenic interference with the climate system' (United Nations, 1992) and a disturbingly high probability of extreme, potentially catastrophic, temperature outcomes in the latter half of this century (Weitzman, 2011). It is widely recognized that developing countries, with

their high climate sensitivity and relatively low adaptive capacity, are likely to be particularly vulnerable to climate change (Intergovernmental Panel on Climate Change (IPCC), 2014a,c; Parry et al., 2007). Finally, responses to traditional development challenges and responses to environmental challenges may not be consistent with each other such as expansion of purchased input use in agriculture.

Developing countries are also crucial to any successful global mitigation strategy. Figure 1 provides a perspective on emission levels, trends and shares. The importance of middle-income and newly developed countries in global annual emissions on a production basis emerges clearly from the figure. In 2010, traditional developed countries, indicated here as members of the OECD in 1990, accounted for about 28% of global emissions and international transport for about 2%. The remaining 70%, or approximately 35 gigatons of CO_2 equivalent per year, is emitted elsewhere. Asia, driven heavily by rapid growth of emissions in China, particularly since 2000, is the largest emitting region. The general trend increase in global greenhouse gas (GHG) emissions is also strongly apparent. Finally, since 1970, the large majority (about 88%) of the growth in emissions has occurred outside the countries that were members of the OECD in 1990.

In order to stabilize the climate, the trends in emissions reported in Figure 1 must quickly cease rising and then bend downwards. According to Working Group III of the Fifth Assessment Report (IPCC, 2014b), achieving a 50% probability of preventing temperatures from rising by more than 2.0 degrees Celsius requires that global emissions in 2050 (in CO_2 equivalent) decline by between 25% and 55% relative to the level observed in 2010. Basic mathematics then dictates that, even if the traditional group of developed countries eliminated emissions entirely by 2050,

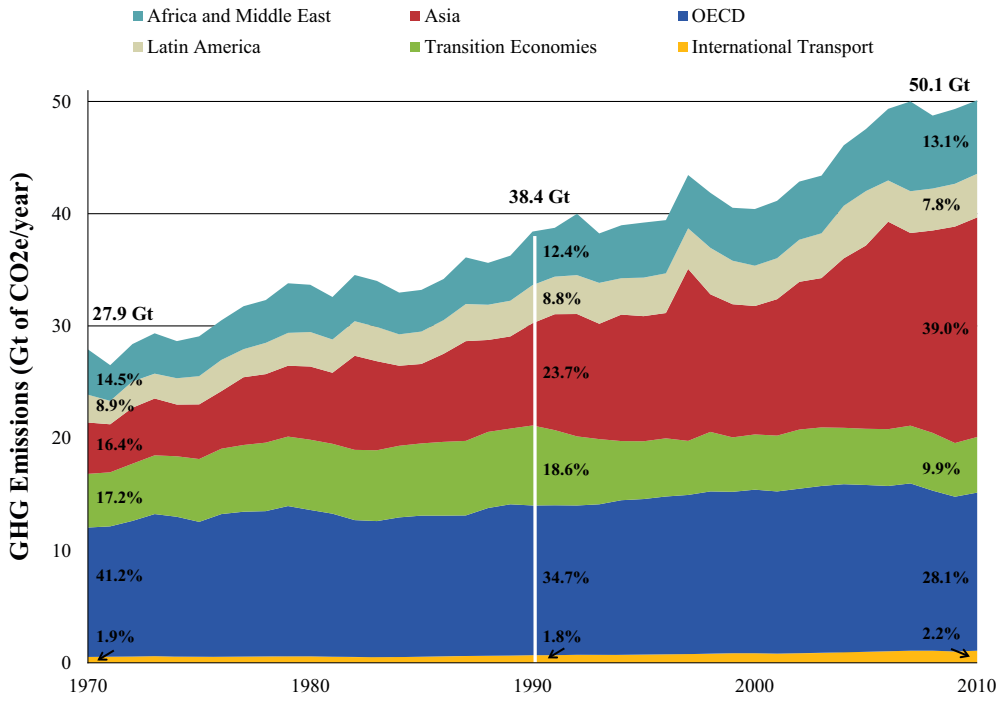

Figure 1. Greenhouse gas emissions in CO2 equivalent per year by region [Colour figure can be viewed at wileyonlinelibrary.com]

the rest of the world, comprised mainly of developing countries, would have to hold emissions at approximately 2010 levels in order to attain the low end of the range of required emission reductions. Furthermore, if this lower end of the range is targeted, net emissions must decline steeply after 2050 reaching negative net emissions (net CO_2 sequestration) in the second half of the 21st century.

In response to this mitigation challenge, a global mitigation process has begun to take shape. At the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change, which took place in Paris in December 2015, countries pledged Intended Nationally Determined Contributions (INDCs) to reductions in emissions. There are, as of June 2016, 162 INDCs listed on the United Nations Framework Convention on Climate Change (UNFCCC) website. Taken as a whole, the reductions in emissions offered in the INDCs represent a decisive break from past trends. Recent analysis by the International Energy Agency (2015) of the offers indicates that nearly every country will have a strong focus on the mitigation of emissions, driving clean energy to more than 50% of world energy by 2040.

In short, the degree of global environmental transformation depends on the pace and nature of transformation of GHG emitting activities, notably energy but also other domains such as agriculture, forestry and land use. In determining this balance of transformations, the countries of the traditional developing world are the decisive players.

The international institutional architecture for fomenting development has, over the past 50 years, faced daunting development challenges and has delivered, at scale, in helping to meet these challenges. As noted, this architecture now confronts a series of relatively novel and interlocking developmental and environmental challenges. Successfully confronting these challenges will require new approaches and a repurposed institutional architecture. In the next section, we consider the response to date of the system to emerging environmental challenges with particular emphasis on climate change.

3. The Response to Date

The particular forms of response to date of aid institutions to global environmental challenges generally and climate change in particular can be divided into three groups:

- Enhance the profile of environmental considerations in aid flows;
- Launch institutional initiatives; and
- Reform existing institutions in order to better address environmental issues.

In the following subsections, we briefly describe and assess each of these responses of foreign aid in turn. For purposes of tractability, we opt to focus on efforts at climate change adaptation within the context of enhancing the profile of environmental considerations. Discussion of efforts at reducing emissions (mitigation) is located under the heading of the launching of institutional initiatives. Finally, we focus on agriculture as a case study in the reform of existing institutions.

Enhance the Profile of Environmental Considerations in Existing Aid Operations

Three major trends emerge from an analysis of a detailed dataset encompassing more than US$5.4 trillion in official government assistance in over a million project/

activity records pulled together by aiddata.org (Marcoux et al., 2013). First, aid flows have been trending towards more environmental assistance for more than three decades. The change is substantial with the ratio of aid characterized as "dirty" to aid characterized as "environmental" falling from about eight in the early 1990s to roughly three in 2008. Second, environmental aid has been increasingly coming from bilateral sources. In 2000, bilateral aid represented about half of the US$10 billion (real US$2000) categorized as environmental aid. By 2008, bilateral aid represented about two-thirds of the US$15billion (real US$2000) categorized as environmental aid. Finally, funding has recently been shifting from local environmental issues to supra-national environmental issues, such as climate change. Roughly US$2 billion (real US$2000) was allocated annually in supra-national environmental aid between 1990 and 2005. This amount has recently increased to nearly US$6 billion (real US$2000), accounting for roughly 40% of total environmental assistance.

Data from aiddata.org also indicate that within the scope of traditional development institutions projects designed to assist developing countries in their efforts to adapt to climate change have formed a significant portion of the recent trend towards more environmentally oriented assistance while efforts to reduce emissions (mitigation) have tended to concentrate under the new institutional initiatives discussed in the next subsection.

From the perspective of aid allocations for adaptation, the following two interrelated questions are pertinent:

(1) When are serious climate change development impacts likely to be felt?
(2) What are the best adaptation options from a development perspective?

The timing of climate change impacts is a matter of debate. Consider, for example, the debate on the implications of climate change for agricultural yields. This debate has the virtue of being relatively well developed and, hence, usefully illustrates a series of fundamental issues. We begin with those finding strong impacts on agriculture and agricultural production in the relatively near term, and then turn to studies that suggest more modest impacts.

For Africa, Working Group II's contribution to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment (AR4) states that "projected reductions in yield in some countries could be as much as 50 per cent by 2020, and crop net revenues could fall by as much as 90 per cent by 2100, with small farmers being the most affected" (Parry et al., 2007). Lobell et al. (2011) use experimental station data on maize field trials in Africa and conclude that "roughly 65 per cent of present maize-growing areas in Africa would experience yield losses for 1°C of warming (very likely to occur prior to 2050) under optimal rain-fed management." The counterfactual in both cases is relative to a "no climate change" baseline. Hence, Lobell et al. (2011) are not necessarily arguing that absolute yields will be lower in future. Rather, they are arguing that yields will be lower than they would be if warming were not to occur. Nevertheless, these are large impacts.

In contrast, Ringler et al. (2010) report reductions in maize yields in sub-Saharan Africa (SSA) relative to a "no climate change scenario" of about 5% on average as a result of climate change by 2050 using process-based crop models developed by the International Food Policy Research Institute (IFPRI). Impacts on other crops vary from stronger (root crops, such as cassava and yams) to slight or mildly positive (rice, millet and sorghum). These estimates are not outliers. The recently

released Fifth Assessment [AR5] (IPCC, 2014c) projects declines in yields in tropical climates of between 0% and 2% per decade and these declines only become likely from the 2030s (once again relative to a no climate change baseline).

These are much smaller impacts and these impacts may be further tempered by carbon fertilization, which has frequently been excluded from process-based studies and is nearly impossible to incorporate into statistical analyses such as those conducted by Lobell et al (2011). It bears repeating that this debate focuses on relatively short term impacts—out to about 2050. The AR5 points out that substantial yield declines are possible under the higher levels of warming that may occur in the latter half of the 21st century.

Agriculture is not the only channel through which climate change may affect developing countries. Recent assessments combine a series of known impact channels and consider growth and development implications out to 2050. These assessments conclude that, while expected climate change is likely to negatively affect overall growth/development with strong negative effects for some sectors and regions, climate change is unlikely to derail development prospects as traditionally conceived at least over the next three decades or so (World Bank, 2009, 2010; Arndt et al., 2012). These three assessments rely on crop modeling approaches similar to those of Ringler et al. (2010). They also ignore impact channels where information has been highly fragmentary, such as implications for human health. Greater reductions in crop yields or the failure to incorporate an important impact channel would result in larger macroeconomic effects with lower income households likely to suffer more.

The broad ranges in estimates of developmental impacts, even in the relatively well developed domain of implications for agriculture, highlight the potential pitfalls associated with adaptation policies. Consider only the quantity and distribution of rainfall. Should one prepare for more or less precipitation? Science gives no certain answer. Unfortunately, while the attention accorded to climate change adaptation has solid foundations, the best adaptation policies are far from clear. The possibilities for "mal-adaptation"—especially preparing for one climate future when a different future may actually occur—are substantial. As a result, it is not always clear that shifting from traditional development priorities to identified or suggested adaptation priorities is in practice the best adaptation policy.

In order to cope with these uncertainties and avoid "mal-adaptation," emphasis in recent work has been placed on flexible and robust policies that provide benefits across a broad range of potential climate futures (Hallegatte, 2009; World Bank, 2009, 2010; Arndt and Thurlow, 2013). Policies and aid programs that allocate greater attention to agricultural research, regional river basin management and vulnerability of infrastructure to extreme events are likely to provide benefits across a broad array of climate futures, and in a variety of both low- and middle-income countries.

More generally, because more developed societies typically have the human and institutional capabilities to cope with shocks and to take advantage of new opportunities, it may well be that the best adaptation to climate change, alongside the flexible and robust policies mentioned above, is rapid development that leads to a more flexible and resilient society. Countries that reach the middle of the 21st century with large shares of their populations engaged in subsistence agriculture, substantial illiteracy and lethargic institutions, may face grim prospects indeed. This is especially true if the global community fails to develop a fair and effective

mitigation policy. As such, the adaptation agenda, in significant measure, reinforces the existing aid and development agenda.

The vast uncertainties associated with climate change underscore, in particular, the importance of two already prominent items on the aid and development agenda. They are:

(1) Human capital accumulation: A more educated populace is more likely to be able to adapt to the challenges posed by global change, whatever they turn out to be. Chen and He (2013) find that educational improvements can translate directly into heightened climate change mitigation and adaption.
(2) Flexible and competent public and private institutions: within any given country, a particular sector or a particular set of regions may be negatively affected, while other sectors or regions may be stimulated.

The basic premise is that a more educated populace, supported by flexible and competent public and private institutions, will be better able to react to the differential implications of climate change as they present themselves. This resiliency to climate change will also apply to confronting other developmental and environmental challenges (Moberg and Simonsen, 2011).

However, even aggressive adaptation policies cannot endlessly substitute for mitigation policies. By approximately the end of this century, warming levels well above 3–4 degrees Celsius are likely on an unconstrained emissions trajectory. Levels of warming with potentially catastrophic implications are clearly possible. Consequently, there is strong interest in mitigation. This mitigation imperative has been a driving (or the driving) force behind a series of institutional aid-related initiatives, to which we now turn.

Institutional Initiatives

We focus here on four aid-related initiatives:

(1) Reducing Emissions from Deforestation and Forest Degradation (REDD+),
(2) Clean Development Mechanism (CDM),
(3) Global Environment Facility (GEF) and
(4) Green Climate Fund (GCF).

REDD+ seeks to compensate countries for emission reductions achieved through reduced deforestation (see Angelsen, 2013). The CDM allows agents in developed countries to purchase emission reductions in developing countries in the hope of simultaneously reducing emissions and spurring sustainable development. GEF is a more traditional aid vehicle, providing a package of grant funding and technical assistance. The GCF emerged out of the 2009 Conference of the Parties (CoP) meeting in Copenhagen as a major initiative to facilitate financial flows from developed to developing countries in order to meet climate challenges. The GCF was forecast to reach US$100 billion per year in financing by 2020 (see UNU-WIDER (2014b) for more detailed summaries).

From the perspective of aid and aid institutions as well as development more broadly, two shared aspects of these four institutional initiatives merit mention.

(1) The main focus is not on low-income countries. The REDD+ initiative is, in considerable measure, dictated by the location of forests. For example,

Angelsen (2013) details the cases of Brazil and Indonesia. With respect to the CDM, more than half of all CDM projects have taken place in China (UNFCCC, 2012). The vast array of projects undertaken by the GEF is weighted towards middle-income countries. Finally, the GCF only recently began operations. However, as with the other funds, the mandate of the GCF would lead to a frequent focus on middle-income countries.

(2) Second, the dearth of public policies designed to limit GHG emissions, at least prior to the agreement reached in Paris at CoP21, has strongly limited the effectiveness of all four initiatives. The functioning of REDD+ is limited by a lack of demand for emission reductions. This has catalyzed a shift towards an entity with features more in common with traditional development assistance (Angelsen, 2013). For the CDM, demand uncertainty for certified emission reductions is the major issue discussed in the 2012 annual report of the Executive Board of the CDM. If nobody demands certified emission reductions, then the CDM ceases to function. The GCF is, at the moment, operating far below the US$100 billion per year originally envisaged. Proceeds from a carbon tax are meant to be a major source of finance for the GCF by 2020. Finally, the GEF was never designed to finance the major transformations required to achieve sustainable emission levels. Rather, the GEF envisions a role in "crowding in" complementary private sector and local finance in order to drive the transformation process. Complementary public policies, such as a price on GHG emissions, would greatly facilitate the ability of GEF to play its envisioned role.

Because the public policy basis for emission reductions has been largely absent, these initiatives have functioned at levels far below those required to make significant contributions to meeting the mitigation challenge. Nevertheless, these four initiatives represent a major share of the international response to date. The lack of a public policy basis has been particularly pernicious in circumscribing the ability of these initiatives to "crowd in" non-official, particularly private sector, funds. This is a key result, stated clearly by Vandeweerd et al. (2012):

> ... actions to promote low-emission and climate-resilient development must be largely public policy-based and private-sector financed where international public finance is used catalytically alongside much larger capital flows. (p. 2)

As a consequence of the missing public policy basis, it is difficult to evaluate whether these initiatives could in practice help catalyze a long-run process of transformation at the scale required while still leaving space for low- and middle-income countries to achieve more traditional development goals.

Nevertheless, the fundamentals behind the four initiatives appear to be sound. Forestry is increasingly regarded as a promising relatively low-cost source for emission reductions, which is relevant to REDD+ (Hertel, 2013a,b; Reilly et al., 2013). An increased reliance on renewable energy sources likely favors regions with more sun, wind and unexploited hydropower potential. These regions are frequently located in developing countries, providing a basic rationale for the CDM. There are manifestly enormous technical and policy challenges associated with transitioning to cleaner energy sources providing a rationale for the GEF, and the basic idea behind the GCF, dedicating a portion of carbon tax revenues to help catalyze investment in low carbon sustainable development, is appealing.

These and other institutions have also been gaining valuable experience in the opportunities and challenges associated with fostering the institutional and technical innovations that will be required to simultaneously achieve developmental and environmental objectives (Hultman et al., 2012). For example, both REDD+ and the CDM confront substantial challenges in information provision and analysis. Specifically, are REDD+ and CDM programs actually reducing emissions on net and are they doing so in a cost effective manner? Focusing on the CDM, a substantial literature now exists that considers the success of the CDM in actually reducing emissions (see, e.g. Schneider, 2007; Sutter and Parreño, 2007; Rosendahl and Strand, 2009; Larson et al., 2010; Lütken, 2011). As credible monitoring of emissions will form a crucial part of any successful global accord to stabilize the global climate, the experience that is being obtained is likely to be useful in domains well beyond the traditional realms of development assistance.

With the successful conclusion of CoP21 in Paris, at least three of these institutions have the potential to apply the experience they have gained in a more favorable public policy environment. REDD+, the GEF and the GCF should play important roles in helping developing countries meet the emission objectives stated in their Intended Nationally Determined Contributions (INDCs) to the reduction of emissions agreed to in Paris at CoP21. Given the firmer public policy basis for emission reductions, more robust evaluations of the performance of these funds is likely to be possible within the next few years.

The short to medium term outlook for the CDM is considerably more murky. The CDM was established under the Kyoto Protocol, which has now been effectively superseded by CoP21. As discussed in Arent et al. (2017), countries are likely to apply a broad array of approaches to meeting their INDCs as pledged at CoP21. While useful for achieving agreement, this system of individual countries establishing their own emission goals as well as the steps to achieving them does not appear to be immediately conducive to the trading of international emissions. As emphasized above, trading of emissions has a role in efficiently distributing mitigation efforts, but the existing institutional system for realizing these gains, the CDM, may disappear alongside the Kyoto Protocol, and it is not clear how to incorporate a trading mechanism such as the CDM within the framework set up under the Paris Agreement from CoP21. Devising a reasonably liquid system for international emission trading currently sits on the "to do" list.[3]

Also on the negative side, these four initiatives are emblematic of the trend towards international fund proliferation in response to specific needs, which appears to be the current institutional response mode, especially to climate change. This mode is unlikely to be the best solution. While climate finance is not the only area subject to fund proliferation, it is a fertile one. The web site climatefundsupdate.org lists, as of June 2016, 27 distinct climate-related funds.

As Arndt and Bach (2011) point out, fund proliferation reflects, at least in part, a lack of consensus on governing structures and distribution mechanisms. While developed countries have preferred using existing structures (notably the World Bank/GEF structure with respect to climate finance), many developing countries have preferred creating new structures with a more balanced representation and more direct distribution mechanisms. These tensions are evident in both climate finance and traditional development assistance. The general principle of direct access is in line with the Paris and Accra Declarations on aid efficiency, and the creation of these funds is in line with the desire from developing countries for new governance structures as mentioned above. In addition, as noted, new funds,

particularly in the climate space, are often directed towards middle-income countries whose capacity to deal with multiple funds is likely to be higher relative to low-income countries. Nevertheless, overall, the fund proliferation phenomenon represents an increased fragmentation of development finance with potentially negative implications for aid effectiveness (see also Bevan, 2012).

Finally, these four institutions are also indicative of the gravity-like force that the climate change challenge exerts on the international institutional architecture. When the focus is on mitigation and energy system transformation, the most obvious and immediate needs are concentrated in rapidly developing and industrializing middle-income economies. Hence, the focus on middle-income economies noted above. In this sense, climate finance potentially diverts attention from the poverty focus that historically has guided the work of many aid agencies.

This brings us to institutional reforms.

Reforming Existing Institutions

Agriculture lies at the confluence of the sustainable development agenda. Agriculture is:

- critical for growth, food security and poverty reduction;
- strongly influenced by population growth and diet upgrading;
- impacted by climate change;
- potentially a source of low emissions energy via biofuels;
- one of the two major drivers towards surpassing the planetary boundaries identified by Rockström et al. (2009) (because of its role as a source of emissions and other pollutants through inputs, production practices and land use change); and
- a potential emissions sink through reforestation and sustainable land management.

Of the 17 sustainable development goals, agriculture (broadly defined to include the food system) will play a critical role in the achievement of at least 12 of them. At least in the relatively short to medium term, achieving economic goals such as eliminating poverty and hunger and increasing economic growth rates in developing countries to 7% per annum is likely to conflict with achievement of environmental goals, such as reducing GHG emissions and marine pollution. Because agriculture is so integral to achieving traditional development objectives and addressing environmental challenges, we focus on agriculture in this section.

In light of the very substantial challenges facing agriculture, Hertel (2013b) argues that "pinning down technological progress [in agriculture] is the key to understanding the long-run trajectory of the agricultural sector, food prices, and global land use." Rapid technological progress in agriculture would also provide space for the simultaneous achievement of often conflicting economic and environmental goals.

From an institutional perspective, it is important to highlight that there are powerful reasons to believe that efforts at achieving technological progress should give heavy weight to developing countries.

- First, Fischer et al. (2014, ch. 8) highlight that farm yields in developing countries, particularly those in Africa, are often a small fraction of potential yields. Closing these yield gaps requires substantial investment in rural

infrastructure; however, under the right conditions (such as access to reliable markets), efforts to reduce yield gaps offer the potential for yield growth at much faster rates than recent growth in potential yield. Given the size of the yield gap, these rapid growth rates could persist for a considerable period of time (two or more decades).

- Second, because population growth and diet upgrading will be concentrated almost exclusively in developing countries, the vast majority of the growth in the demand for food will also be concentrated in developing countries. Food is most logically produced near potential demand sources. Again, Africa looms large in population projections and potentially in diet upgrading. According to the UN medium variant population projections, Africa will account for about half of global population growth between 2010 and 2050, by which time, nearly one in four people on the planet will be African. If the current economic growth rates that are being experienced on the African continent persist (or accelerate) and the benefits of this growth are reasonably well shared, then rapid diet upgrading is highly likely to occur as well.

Historically, agriculture has produced some clear and large successes attributable to foreign assistance. For example, the Consultative Group for International Agricultural Research (CGIAR) is credited with developing the technologies that enabled the "green revolution" in Asia from the 1960s. More recent assessments of the returns to agricultural research generally find high returns (Hazell, 2010; Hurley et al., 2014; Alene and Coulibaly, 2009).

Yet, experience also clearly indicates that it is possible to waste substantial resources on bloated institutions as well as misguided agricultural interventions and policies. This is true both for countries and donor agencies. For example, rhetoric notwithstanding, aid agencies have not yet effectively addressed the tensions, easily apparent in agriculture, between environmental challenges and their traditional poverty focus.

In a recent review, Von Braun (2013) finds that the relevant international institutions focused on agriculture do not deliver the necessary public goods at the needed scale. He emphasises the need for bold reform and provides a list of seven international public goods that the global system must aim to provide to function effectively:

(1) Natural resource management related to biodiversity, water and soils;
(2) Climate change adaptation and mitigation;
(3) Trade and food reserves;
(4) Sound competition policy and standards for foreign direct investment;
(5) International research and innovation in food and agriculture;
(6) Responding to and preventing food and nutrition emergencies;
(7) Trans-boundary food safety and health-related investments and standards.

Concerted action in agriculture and agricultural research no doubt holds many of the pieces of the jigsaw puzzle required to address the current tradeoffs inherent in the combined search for economic development and the pressing need to address environmental challenges. In hopes of better meeting these challenges, some reform efforts have been ongoing. For example, CGIAR recently reorganized itself around a series of 15 collaborative research programs. The idea is to bring to bear multiple perspectives from different centers of expertise on complex problems. The

challenge of increasing production while preserving local environmental quality in the context of climate change was a major motivator behind the reforms. Reform efforts at other important institutions in the agricultural sphere are less advanced.

The general lesson emerging is that a reshaping of the international institutional for agriculture is indispensable for confronting the multi-faceted challenges of the 21st century. We highlight that these are areas where the state—and by implication foreign aid—has traditionally been assigned important responsibilities both to deliver necessary public goods and to provide appropriate frameworks for private sector activity. Clear articulation of 21st century challenges, along with the necessary institutional updating, to stakeholders broadly defined, not least taxpayers in contributing nations, will also be required.

4. The Future Role of Aid in Environment and Climate Change

In considering the future role of aid in environment and climate change, we begin by reflecting on the potency of development assistance. Subsequently, we outline five lessons, which in our assessment stand out. They are meant as a roadmap to the future roles of aid in environment and climate change.

Setting the Level of Ambition Right

"Can aid save the planet?" In our assessment, asking a question such as the one just put is outright dangerous in relation to foreign aid. It leads (implicitly) to inflated expectations—and the obvious answer is "*No*", for all kinds of reasons (including aid's relatively limited size). Yet, this simple one-word response leads in turn to another (implicit) and equally erroneous impression, namely that there is nothing aid can do. Aid can, based on past experience, do quite a lot, even if it cannot by itself save the planet.

Five Key Lessons about Aid's Future Role

Lesson 1 Development assistance designed principally to achieve welfare improvements in poor countries remains important. While numerous countries have graduated to middle-income status, 36 countries remain mired in low-income status. Strong forces, mainly the shifting geography of poverty and the rise of global environmental issues, are drawing attention towards middle-income countries. As will be discussed in Lesson 2, greater attention to middle-income countries is merited. At the same time, this represents a potential threat to the level of attention to low-income countries. Insufficient focus on low-income countries may arise either explicitly, via decisions to directly reduce allocations to those countries, or implicitly through the allocation of resources to dedicated funding vehicles whose activities tend to concentrate in middle-income countries. In this context, it is important to recognize that, after 50 years of assistance, the countries that continue to be mired in low-income status are likely to be more difficult cases (Collier, 2008). Each case will have its own particularities and reliance on the formulas that have been tried over recent decades may not be the best approach. Alternatively stated, inadequate focus on these more difficult cases would compromise their growth and development prospects.

With respect to environmental considerations for aid to low-income countries, it is worthwhile emphasizing that aid is a long-run forward-looking enterprise. Arndt

et al. (2010, 2015a,b) find that economic growth implications of aid only emerge after a long period of engagement (up to three decades). Aid is meant to facilitate recipient countries' efforts to transform their economic and social structures towards more desirable outcomes. Decisions made in this process, for example, in basic economic infrastructure, have lasting implications. The role that environmental considerations, particularly global environmental considerations, should play in these decisions is a matter of judgment. There is, for example, ample justification for substantial emission growth as part of the process of achieving growth, food security and other socio-economic objectives in low-income countries.

At the same time, an important lesson of the past 50 years is that low-income countries often grow and become middle-income countries. Under the desired state of the world, the current set of low-income countries will become middle-income countries in the context of globally declining GHG emissions and a stabilizing climate. Given that major investments being made in the near term will influence economic structure in the long term, environmental considerations rationally enter current investment calculations in many low-income countries. It would be unfortunate for the currently low-income countries to arrive at middle-income status with an economic structure that requires transformation in order to cope with 21st century realities, particularly if more appropriate structures could have delivered the same development performance. Indeed, one of the few advantages associated with low-income status is that future economic structure is, in considerable measure, a matter of choice.

Lesson 2 Notwithstanding Lesson 1, it is desirable that the share of attention that the aid system devotes to middle-income countries increases without crowding out resource transfers to the low-income countries. This is driven by (i) the concentration of absolutely poor people in middle-income countries, (ii) the key role that middle-income countries must play in combating global environmental problems and (iii) the needs of middle-income countries for some assistance in adapting to climate change. As the aid system has accumulated substantial experience working with countries that are now middle income, it makes sense that this experience is intelligently deployed to confront new challenges.

Nevertheless, there are important differences between low- and middle-income countries that aid institutions must address. In particular, in low-income countries, aid financial flows are frequently macroeconomically very significant. In middle-income countries, concessional aid flows are almost invariably relatively small in macroeconomic terms and are highly likely to remain so. Desired development and environmental goals must be achieved through appropriate policy frameworks and investment decisions funded principally through private sources or domestic public finance.

Under these conditions, aid can only hope to play supporting and catalytic roles that fall under the rubric of soft assistance. Examples of these roles for confronting environment and development issues include:

- technology development and transfer;
- regulation and regulatory frameworks;
- other policy advice;
- institution building;
- information systems;
- other analysis and technical assistance; and

- leveraging private flows or taking on some risk in order to encourage private flows with a view to both expanding the magnitude of the flows and/or channelling their application to the benefit of lower income households.

Two aspects of a trend towards soft and/or catalytic assistance merit mention. Because aid, in these contexts, is almost certain to be small relative to the application of domestic resources, the leverage that aid effectively receives opens the possibility for very high returns on aid investments. For example, if US$10 million in soft assistance ends up increasing the annual social return on a US$1 billion investment by 1%, then the benefit/cost ratio to the aid is very sizeable.

Second, to the extent that the aid system was designed at all, it was designed with the objective of helping poor people in poor countries. At its best, this system worked with domestic institutions in poor countries, which were invariably characterized by distinctly limited capacity, to develop broad scale packages of policies, technical advice and finance. In contrast, middle-income countries are a lot less likely to demand traditional broad scale aid packages that effectively cede a major role in strategic decision-making to donor capitals. Recipients' greater technical capacity combined with the small relative size of aid render these packages increasingly less necessary and less politically acceptable to recipients. Even functioning at their best, it is not clear that traditional aid institutions are properly configured to help middle-income countries confront their interlinked developmental and environmental challenges.

In other words, institutional inertia threatens to stifle needed shifts in focus. Moreover, as argued for agricultural institutions, articulation of needs and associated institutional reforms is also required to ensure stakeholder buy in.

Lesson 3 The role of aid and aid institutions in the provision of global/regional public goods should be maintained or enhanced. Agriculture presents a particularly good example (though not the only one). Particularly as part of an effort to reform and reconfigure international agricultural institutions such that they better respond to 21st century challenges, there is a strong rationale for enhanced investment in international agricultural systems. For agriculture, the case for an emphasis on technology and investments to reduce gaps between actual and potential yields is particularly strong. Unlike other areas such as power generation, where improved solar panels are likely to work just as well in Africa as in North America for the same level of solar radiation, agricultural innovations tend to be strongly location-specific.[4] The spill-overs to developing countries, particularly those in Africa, from public and private agricultural research in developed countries may be limited.[5] Given the critical global role agricultural sectors in developing countries will play in the first half of the 21st century, there is, as already argued, a convincing rationale for major investment of aid funds in international agricultural systems.

Other areas with obvious roles for aid include trans-boundary river basin management, regional growth arrangements including regional power pools and technology generation, where, as in agriculture, global research advances may not apply to developing countries (e.g. cook stoves).

Lesson 4 Assist with the financing of the transformations required to confront environmental issues. There are fundamental rationales behind the design of the new aid initiatives discussed (REDD+, CDM, GEF and GCF). The world

community, via the CoP21 Paris agreement and the collective weight of more than 160 country INDCs, has begun putting in place a global mitigation regime. The REDD+, GEF and GCF institutions are well-positioned to make substantial contributions to helping developing countries achieve their INDCs. They should be supported in this objective and evaluated accordingly.[6] The development of appropriate institutional frameworks for emissions trading, as in the CDM, is likely to take on increasing importance over time hard return.

Lesson 5 While, in principle, aid for information could be categorized under Lesson 3, it deserves special mention. Aid has long been recognized as a knowledge-intensive activity. Indeed, institutions such as the World Bank now bill themselves as "knowledge banks;" and the information needs of developing countries have underpinned the creation of institutions dedicated to providing these needs (such as UNU-WIDER).

Two points merit particular mention. First, Lessons 2–4 serve to place even more emphasis on the role of information collection, organization, analysis and dissemination. These roles should become even more central in aid efforts as recognized in the formulation of the SDGs, which has spawned repeated calls for a data revolution.

Second, looking forward, the desired state of the world envisions that global GHG emissions peak in the relatively near term and then decline fairly rapidly thereafter. An adequate monitoring system that independently and credibly tracks emissions at country levels is necessary for properly assessing progress towards achieving the emission reductions set forth in country INDCs. Without such as system, it is hard to see how consistent, long-term emission reductions could be achieved.

In principle, fossil fuel use is relatively simple to monitor as fossil fuels come from (or pass through) a few reasonably easily distinguishable points. As noted by Angelsen (2013), the other principal sources of emissions, agriculture and deforestation, pose much greater, though certainly not insurmountable, measurement challenges.[7]

This auditing task would appear to be indispensable. Historically, aid institutions have often housed data and auditing tasks together with operating units within the same agency. There is, in this instance, a good case for creating a new, specialized, independent and technically competent institution that would credibly monitor and corroborate country level emissions data in order to properly track emissions at the global level.

5. Conclusions

Development aid, by itself, cannot 'save the planet' and secure much needed and much desired outcomes in furthering development, poverty reduction and environmental stewardship. At the same time, the weight of evidence does indicate that development aid and development institutions do have a track record in contributing to the realization of development objectives. This is a considerable achievement given the massive scale of the development challenges that existed circa 1970. As such, it seems reasonable to believe that development aid and aid institutions have the potential to become important catalytic actors in achieving interlinked developmental and global environmental objectives.

However, this aid architecture confronts new issues within a new context. It was principally designed to assist poor people in poor countries in an era when global

environmental issues were, at most, a distant glimmer. This same architecture is not well suited to the new geography of poverty that situates most poor people in middle-income countries and an era where addressing global environmental change is widely viewed as one of the defining issues. The five lessons identified are meant as guides in the necessary restructuring of the international institutional architecture. Implementation of the complementary policy frameworks is also a necessary condition. Without restructuring and appropriate complementary policies, future aid, particularly aid for environmental objectives, risks substantially underperforming.

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Notes

1. See the list of 17 SDG goals available at http://www.un.org/sustainabledevelopment/sustainable-development-goals/.
2. See also Arndt et al. (2010), Clemens et al. (2012), Juselius et al. (2013), Mekasha and Tarp (2013), as well as UNU-WIDER (2014a), which is a comprehensive position paper providing an up-to-date review of existing aid-growth literature. In more recent literature, Roodman (2015) disputes the findings of Clemens et al. (2012) and suggests lower returns. His contribution does not appear in Arndt et al. (2015b) because the data sets he employs span less than 30 years. In addition, a response to Roodman (2015) can be found in Bazzi and Bhavnani (2015).
3. While REDD+ is also a form of emissions trading, it is, compared with the CDM, much less dependent on a liquid market for certified emission reductions as it relies upon broad institutional agreements across numerous actors. In this sense, the increased demand for

emission reductions catalyzed by the Paris Agreement may well stimulate activity in REDD+.

4. While the process of converting sunlight to electricity functions in essentially the same way in the developed and developing world, developing countries may require additional innovations in finance because developing countries typically face higher opportunity cost of capital and the costs of renewable technologies are typically front-loaded. Institutional structures for power generation and distribution are location-specific and highly relevant to the pace and nature of technology adoption.

5. For example, one of the most widely used biotechnology innovations in the USA is herbicide resistant maize. This innovation is of limited value in contexts where very little herbicide is used.

6. Crowding in of private sector funds is, as noted, critical in this context. Further discussions on this and other points can be found in UNU-WIDER (2014b).

7. Measurement and verification are equally salient for the preservation and/or expansion of GHG sinks as envisioned under payments for environmental services.